



UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

EBI4016 – BIOELECTRIC

11 OCTOBER 2017
2:30 p.m. – 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 3 pages including cover page with 5 Questions only.
 2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
 3. Please write all your answers in the Answer Booklet provided.

Question 1

- (a) Briefly describe excitable cells. [2 Marks]
- (b) Sketch the typical waveform of action potentials generated across the cell membrane of an excitable cell with appropriate labels for the important phases of this waveform. [4 Marks]
- (c) Briefly describe how an action potential is generated across the cell membrane of an excitable cell. [7 Marks]
- (d) Briefly describe the ion transport mechanisms (pump, active and passive channels) in the cell membrane in terms of its properties and functions. [7 Marks]

Question 2

- (a) It has been established in bioelectricity studies the phenomenon where a frog leg moves as a result of current passed through the nerve. This occurs when the muscle of the frog is simultaneously touched with a bimetallic arch. Why does this phenomenon occur and justify your answer in terms of electric currents, action potential and the stimulated nerve. [7 Marks]
- (b) Briefly describe over-potential of biopotential electrodes and explain the three types of over-potential in biopotential electrodes. [7 Marks]
- (c) Briefly describe a cardiac pacemaker [2 Marks]
- (d) Describe the four design requirements for implementing an implantable cardiac pacemaker. [4 Marks]

Question 3

- (a) Briefly describe an electroencephalogram (EEG). [2 Marks]
- (b) Describe the difference between the individual alpha, beta, theta and delta brain waves. [8 Marks]

Continued...

- (c) Describe the working principle of biopotential electrodes in terms of the oxidation-reduction reactions which are used for measuring bioelectric signals.
[10 Marks]

Question 4

- (a) Briefly describe cardiac fibrillation.
[4 marks]
- (b) Describe how a cardiac defibrillator functions to revive a patient who has just suffered from cardiac fibrillation.
[7 marks]
- (c) Nerve stimulation is the application of electric signals on the surface of the human body. Briefly describe how it works.
[5 marks]
- (d) State the benefits and problems associated with applying electrical stimulation on the surface of the human body compared to applying such stimulation inside the bodily tissues.
[4 marks]

Question 5

- (a) Briefly describe why transient protection is critical in electrocardiogram (ECG) amplifiers.
[4 marks]
- (b) Sketch a typical transient protection circuit and briefly describe the operation of this circuit towards protecting the ECG amplifiers.
[10 marks]
- (c) Briefly describe the let-go current.
[2 marks]
- (d) Briefly explain the types of electric shock which can be encountered in a medical environment.
[4 marks]

End of Paper